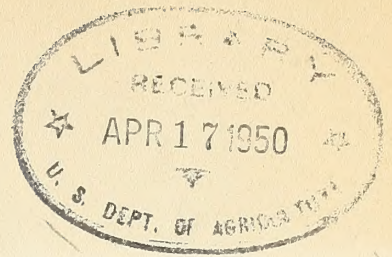


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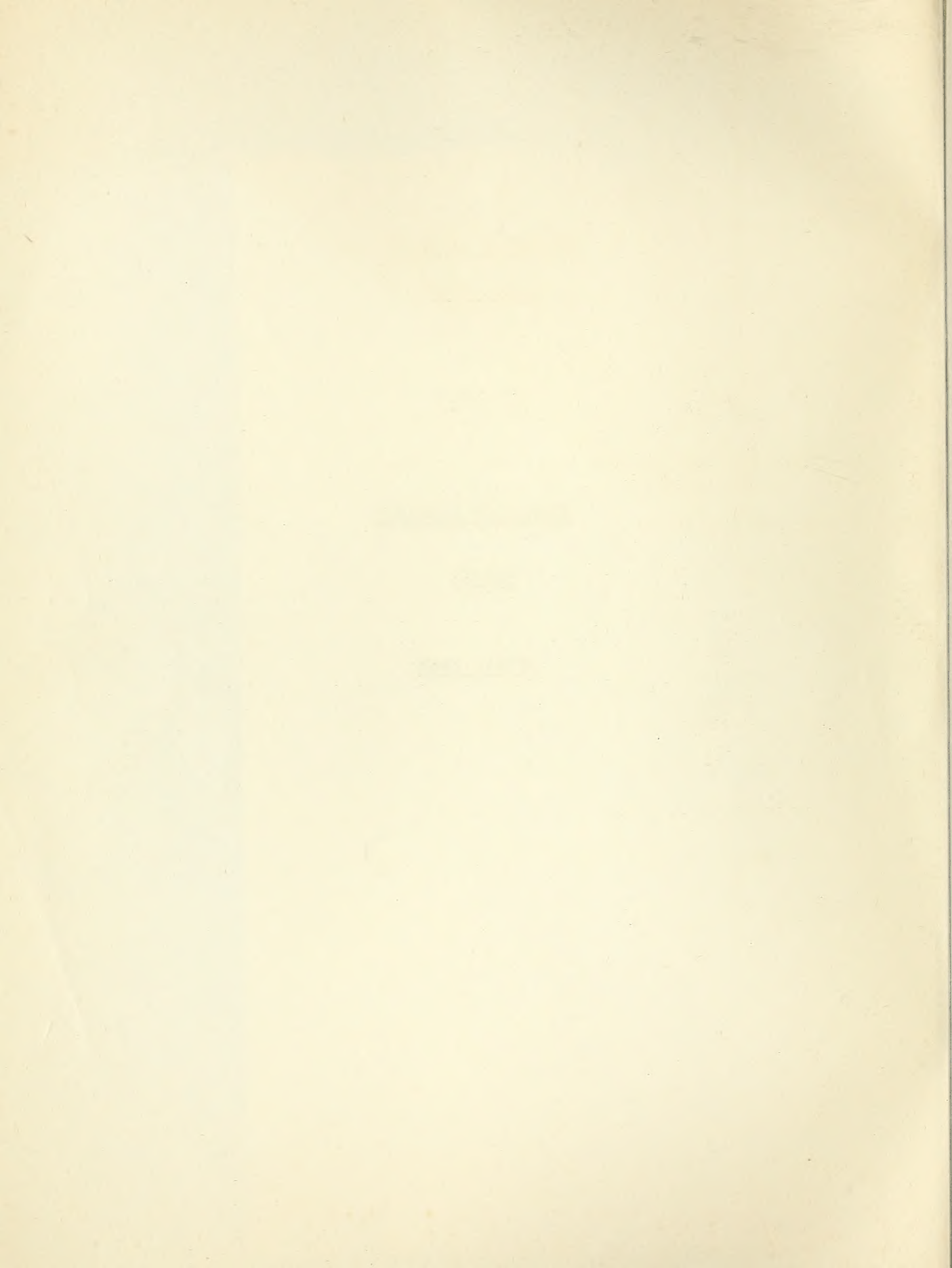
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BRANCH OF RESEARCH

REPORT

APRIL, 1935

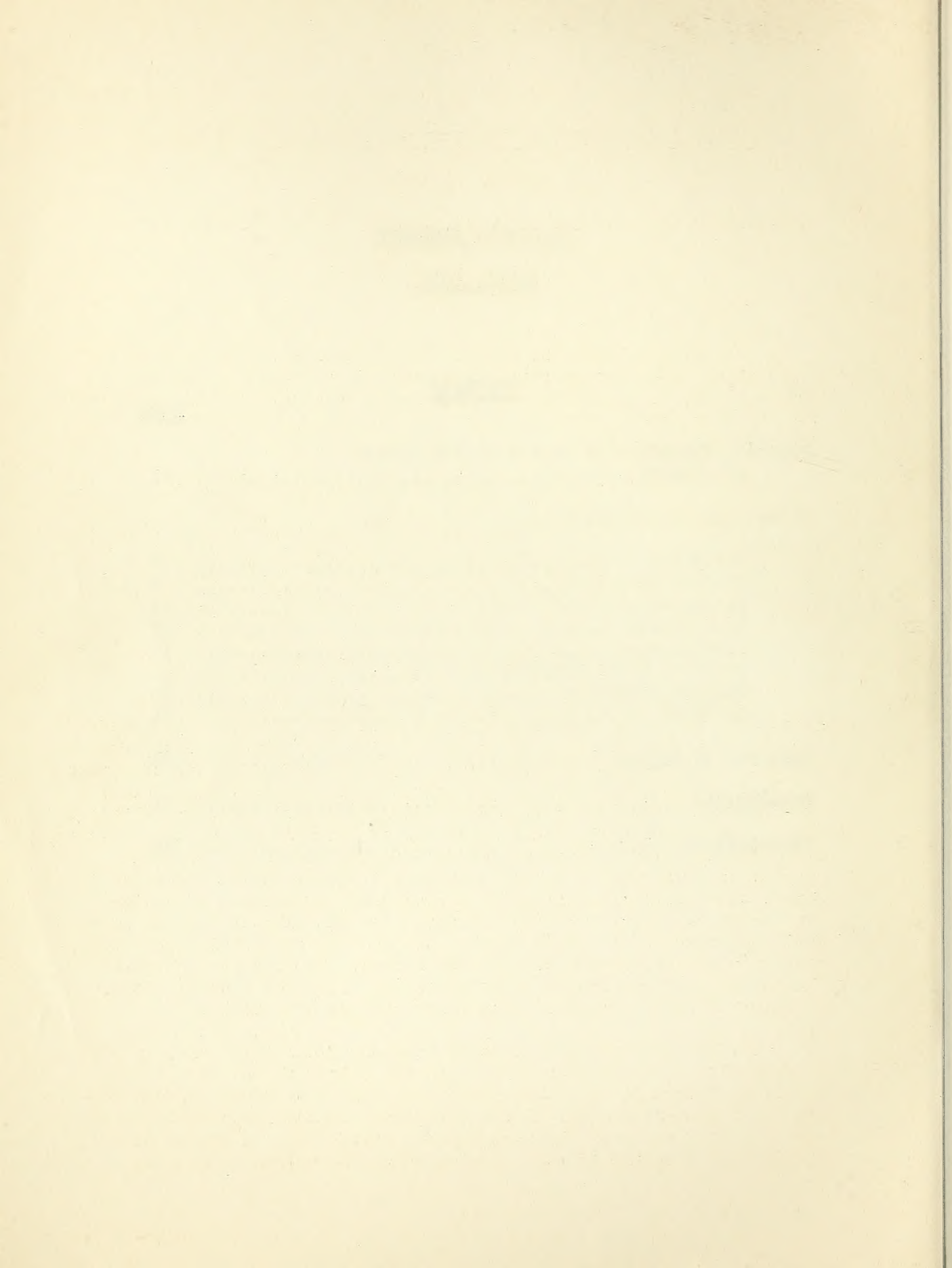


BRANCH OF RESEARCH

April, 1935

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PRUSSIAN EXPERIMENTAL INSTITUTE FOR FOREST MANAGEMENT

Second Division

Review of its activity from Apr. 1, 1933, until Mar. 31, 1934.

Report of Prof. Dr. Wiedemann.
(Translated)

In October 1933, the former "Prussian Experimental Forest Institute" has been incorporated as "Second Division" into the new "Prussian Experimental Institute for Forest Management" whose general direction was placed into the hands of Inspector-General of Forests, Dr. Hausendorff.

The activities of the Second Division are as follows:

1. The research is conducted on 276 sample plots. In view of the increasing lack of funds only twenty new plots were established. Less than one-tenth of this year's plots are for yield studies mostly of alder. These were needed in the revision of the alder yield tables.

Of studies the following are to be emphasized:

Fertilization experiments in Neuenheerse, Altenbecken and Straupitz, which for the first time contain exact data on the influence of lime fertilization in the older pine and spruce stands; comparisons of increment of pure spruce stands and mixed stands of spruce and beech in Central Germany; thinning experiments in younger pine stands on good (Falkenberg), medium (Chorin, Serno) and poor (Peitz) soils, during which there also were tested thinning in the upper storey, pruning and soil cultivation; new data on the testing of races at Chorin; the experiments in the two-storied pine-seedling forest at Serno; the numerous experiments on productive management of heathland planting in Northwestern Germany; also the extraordinarily valuable experiments at Petkus on the reproduction of certain pine stems made with the permission of Mrs. von Lochow. The interval between the two surveys was four years throughout. In a few younger plots, an interval of two years between thinnings was maintained.

2. The completion of special investigations this year, in view of curtailed appropriations, was possible only with the aid of cheap auxiliary forces still in the process of education (forest-probationers and forest-students). A few unemployed communal candidates also were put to work under the unemployment relief law. A series of cultivation experiments were carried out. The course of growth,

development of root-systems and soil conditions were studied on the poorest sites of Eastern Germany, so as to overcome the difficulties experienced there. To these are to be added a series of special investigations on the dying of Abies, development of roots on different soils, stem analyses and preparation of volume tables for the East-German pine.

3. The Auxiliary Laboratory of Soil Science is indispensable for a rational estimation of the results of experiments. It completed the survey of the experimental beech plots and continued the work on different site changes in soils occurring in spruce stands thinned by various methods, lime fertilization, and admixture of the beech. Besides it participated in the examination of the poorest soils of Eastern Germany. For practical purposes soil borings were made and soil maps prepared in a few forest areas of Eastern Germany. On this occasion there was observed a surprisingly marked effect of former mistreatment of soil upon pine growth.

4. Of the publications issued the following ones are to be mentioned: "Die Beziehungen des forstlichen Standortes zu dem Wachstum und dem Wirtschaftserfolg im Walde" (The relations of the site to growth and yield of the forest) published for the "Notgemeinschaft der Deutschen Wissenschaft" (Relief Society of German Science); a test of silvicultural data by Prof. Oelkers; a contribution on the results of experiments on the reforestation of wasteland; a report on the present stage of research work in the North-western German heathland.

The Assistant-ecologist Dr. Ganssen completed his investigations on North-German beech stands.

The repeated curtailment of appropriations forced us to limit all expenditures to the utmost, even in the case of reexamination of plots that had been included in the work plan.

CALIFORNIA FOREST EXPERIMENT STATION

Forest Management - Pine Region

Direct Seeding

To profess any faith in the possibilities of direct seeding of ponderosa and sugar pines invites a polite reference to those nearly uniformly disastrous failures of 1908 to 1913. Yet the fact remains that natural seedlings do grow. Also planting has been only slightly more successful.

We have not dared to risk duplication of those earlier failures on a large scale, but since 1926 we have dabbled with direct seeding in connection with the study of natural reproduction. Seed with wings has been sown on top of the ground and with a cover of soil, with and without soil cultivation, with eradication of competing cover and without eradication, with rodent screens and without them, with rodent poisoning and without, on burns and where the cover was undisturbed.

The net results have not been large, mostly negative, and not very new. But we still have faith.

First of all more care must be exercised to obtain good seed. Much of the seed used in the past was so poor that even the rodents wouldn't touch it. By contrast, seed from selected trees furnished by the Placerville Erosion Control Nursery yielded over 90 per cent of good seedlings. Next, it is nearly useless to sow seed on top of the ground. Broadcast seeding offers little promise. The seed should be covered in spots of mineral soil where there is room for a tree to grow; it is useless to sow seed where the ground is held by other vegetation. Fall seeding is necessary, especially for sugar pine. Last, and equally important, rodents must be controlled. No seedlings of any consequence have ever been experimentally established where rodents were not excluded by screens, fire or poisons, until after the seedlings become woody - a few weeks after germination.

Elimination of rodents appears to be the most difficult. Eradication of shrubby weeds is not an insurmountable difficulty. The clipping of established seedlings by rabbits, deer, etc., common to planted stock also, usually is not serious enough to prohibit reforestation. But efforts to control the small seed eaters have met with little success. Skeptics should remember, however, that relatively little research has been done on this complex problem. The failures of 25 years ago merely emphasize the need for careful study. Since those days the Biological Survey has developed efficient methods of controlling those species on which they have concentrated. The most

distinctive seed-eater, the white-footed mouse, is doubtless the most successful mammalian species in North America. It is not to be expected that amateurs, or even experts without intensive study, can hope to control successfully such a species.

Fortunately the outlook is good for real cooperation by the Biological Survey in this problem of rodent relations. There is little doubt that success will be attained. In my opinion direct seeding will take an important place in reforestation, but until methods of rodent control have been developed, large-scale seeding projects should not be attempted.

Forestation

Tree-seed Viability

The seed-storage experiment started in 1929 by Siggins has shown the following results:

Species	Original 1929 germination test, per cent	1935 Germination test, per cent	
		Seed stored at room temp. ^o	Seed stored at 40 ^o F
Jeffrey pine	41	30	53
Sugar pine	37	11	17
Ponderosa pine	31	4	11
White fir	70	0	0

White fir lost completely its vitality after four years of both room and cold storage. The beneficial effect of cold storage on viability of all three species of pine is pronounced.

Range Research

Pine Reproduction and Grazing

For years in the east-side ponderosa-pine types of California, foresters have noted the local inadequacy and poor distribution of advance reproduction in uncut timber stands and - during the past decade, particularly, - the frequent failure to obtain satisfactory restocking of cut-over lands. One of the major phases of the pine project of Range Research is therefore concerned with this question of whether livestock may have been at least partially instrumental in bringing about these forest conditions.

Prior to the completion of a detailed working plan for this project, a preliminary survey was made on a typical block of pine range on the Black's Mountain Experimental Forest (Lassen National Forest) to obtain advance planning information on the amount of livestock damage to established reproduction. The survey covered an area of 3,290 acres of dual-use range. The results substantiate the general observation that such damage is of little consequence except in localized areas along stock trails and driveways, on sheep bed grounds, and in the immediate proximity of stock watering places. A total of 329 mechanically spaced plots, 4 milacres in size, were examined. Only 222 of these plots supported trees. Damage in some degree from all causes, was recorded from 107 plots (48.1 per cent); but approximately one half of all damage was confined to 8 plots (3.6 per cent).

Critical examinations were made of 2,168 trees 5 feet in height and less. Of the 34,379 "parts" (laterals, leaders, needle clusters, etc.) actually counted, only 10.5 per cent revealed damage from any cause (livestock, insects, frost, rodents, porcupines, snow, mistletoe, or unknown). Damage attributed to livestock totaled 2.7 per cent; and this damage doubtless included some deer injury, since in most cases it was found impossible to differentiate between deer and livestock damage.

Only three records of damage during the current season were observed; all other cases represented an accumulation over a period of years. Moreover, dead trees within the five-foot height class were very few in number.

On the whole, the conditions encountered on this particular area are not at all alarming, insofar as established reproduction is concerned. It seems likely that the death of trees in the seedling stage may have an influence on the future stand. Consequently, in our studies of the extent to which livestock grazing is detrimental or beneficial to a virgin or a cut-over forest, it is proposed to devote particular attention to the effect of grazing on the survival of pine seedlings.

Forage Sampling

The gathering of forage data on approximately 800 temporary sample plots located at mechanical intervals over the 3500 acre San Joaquin Experimental Range comprises the major research activity. The description of vegetation made up principally of animals during this preparatory year when no grazing is being permitted should be of especial importance, both for its calibration values between pastures and also for the basis it will provide for future comparisons of pastures treated in different ways. Over vast foothill areas, the present forage crop is regarded by old timers as the best in 30 or 40 years.

Erosion - Streamflow

Experimental Flumes

Tests with 1-foot modified Parshall flumes were run for the purpose of rating the smaller size with sloping entrance floors and with 45° fillets in the converging section. Neither method proved satisfactory for the transportation of debris; and, as in the 5-foot flumes, sloping entrance floors caused an unstable flow condition at low water stages. The insertion of fillets in a flume with level floor gave a rating close to Parshall's.

Tests were also made of a Parshall flume with level entrance floor, and with six sloping 45° fillets installed across the floor. This alteration failed to improve debris transportation sufficiently, and gave unstable flow conditions at the lowest stages.

Tests were made on a 1-foot flume of radically different design, worked out by Wilm with cooperation of Storey and Cotton. This flume, rectangular in cross section, with parallel walls and curved intake, is constructed to cause a drop to critical depth at its intake, while water stages are measured where the flow is running below critical depth. The flume gives a smooth rating curve, and cleans itself perfectly, carrying through debris ranging in size up to 5-6 inches. Tests of a similar flume 3 feet in width gave very similar results. The design is being perfected and standard dimensions worked out for all sizes of flume.

Fire Research

Transportation Planning

This project, supervised jointly by Cronemiller of the Regional Office and Brown of the Station staff, has shown rapid recent progress in completion of individual forest plans. Within the last month seven proposed plans have been submitted to conferences for analysis and approval. The series of conferences has covered new plans for four northern forests and revisions of existing plans for the Eldorado and Lassen, also of the pine group. The most recent conference has covered proposed development plans of the San Bernardino. This is the first of the four southern chaparral forests completed. As previously described, an entirely new approach was necessary in building transportation plans for this group. These plans concern many Regional policies and of necessity must set up complete protection plans before transportation needs can be defined. The place of firebreaks in the fire protection scheme of these forests is perhaps the most debated question, as it concerns the plans and construction authorizations.

Multiratio Drafting Projector

A new model of the drafting projector, evolved in connection with map compilation work in the protection planning projects, has been completed recently.

The machine, by means of a wide-aperture lens, an optically flat mirror, and a light source, picks up the image of a map or any data it is desired to copy and projects it onto a work table. By varying the distance ratio between the object and lens and the lens and work table, the image can be projected to various scales. The model just put into operation has been designed to accommodate reduction and enlargement ratios from 4:1 to 1:4. It eliminates slow and unsatisfactory work with the pantograph and substitutes well for the light table. It is particularly valuable for transferring superimposed data from an original map to maps of identical base but different scale. Adaptability to photostat and blueprint work has not yet been fully tested.

In design, precise vertical and horizontal adjustment which varies the ratio between the object-lens distance and the lens-mirror-table distance is provided mechanically by means of worm gears and acme threaded screws driven by two small electric motors. This adjustment plus a provision for changing the position of the lens and two variable sections to change the work-table height provide for the full range of reduction and enlargement from 4:1 to 1:4. The frame of the machine is of duraluminum and Cooper-Hewitt mercury vapor lamps are installed for possible photostat and blueprint work.

A complete illustrated description of the machine and performance data will be available shortly.

Products

Notes from 5-County Land-use Study

Lumbering in the 5 counties of El Dorado, Placer, Nevada, Yuba, and Butte is centered mainly in 5 large band-mills located in relatively large population centers. Scattered throughout the belt of mixed virgin, culled, and second-growth timber below the national-forest boundary, however, are 35 small portable outfits which cut about 20 million board feet a year and account for nearly 20 per cent of the total production.

Total lumber production in the 5 counties averaged about 125 million board feet during the last 7 years, but only about 13 per cent of the cut was used locally. Most of the ponderosa and sugar pine is cut into box shooks for Sacramento Valley markets, while the higher grades of lumber and mill-work are shipped to Eastern and to

California markets. Since the local cut accounts for only about 40 per cent of the total lumber requirements in the 5 counties, more than 20 million board feet apparently are imported annually into the area, chiefly from Oregon.

The lumber cut by these portable mills ordinarily is used locally, partly because portable-mill lumber usually cannot compete in outside markets. Too frequently the output of the small mill is poorly manufactured, improperly seasoned and sold ungraded. It seems probable that somewhat larger, more efficient, and centrally located mills would produce better lumber and at the same time provide more social advantages for the employees.

During 1933 these small mills provided part-time work for about 440 employees. For all the sawmills in the 5-county area approximately 1,800 employees received an average of \$760 in wages and salaries during 1933 for an average working season of about 7 months.

CENTRAL STATES FOREST EXPERIMENT STATION

Forest Planting

Growth of Pine in 1934

Remeasurements of the pine plots in plantations at the Boy Scout Camp in Delaware County, Ohio, were made by Kellogg during April. Scotch pine continued to maintain its good initial growth. Height growth in 1934 varied from 1 to 3 feet, and averaged slightly over 2 feet; diameter growth varied from 0.2 to 1.4 inches, averaging 0.66 inches D.B.H. The drought of 1934 showed little effect on this plot. Norway pine height growth, which had averaged 1.07 feet in 1933, dropped to 0.97 feet in 1934. White pine showed the effect of the dry season, since its height growth averaged only 0.5 feet in 1934.

Nursery

In cooperation with Professor Alex Laurie, of the Ohio State University Department of Floriculture, seedbeds of shortleaf pine and black locust are being established at Columbus, using Ohio seed. Portions of the pine seed are being stratified prior to planting, and variation in light intensity will be made on the shortleaf beds to test the effect of pretreatment of seed and shading on this species.

Chapman is preparing a series of black locust beds to test the hardiness and maturation of wood for seedlings started at progressively later dates throughout the summer. Initial beds have been planted. Others will follow a month apart, the last one being made on August 1. In his survey, Chapman saw indications of winter killing in locust plantings where the stock was developed from seeds sown in August.

Small quantities of sugar maple, black cherry, and beech seed were planted by Myer and Kellogg, to secure some stock of known origin for trial in underplanting black locust, in cooperation with R. C. Hall. Although the season has been slow in developing, the maple and cherry seed were already sprouted in the sand medium used for stratification. In the future these species will not be stratified but will be planted in beds in the fall and mulched to prevent freezing and undue exposure of the seeds.

Forest Insects

Locust Borer

Harold A. Waters, who worked on the locust borer investigation as field assistant during 1934, was reappointed. The latter part of the month he worked with Page on a study of larval survival on the permanent Ohio plots at Cambridge, Hopedale, and Minerva. Further mulching and fertilizing experiments were started at Cambridge.

Eight thousand field-dug "shipmast" locust sprouts from Long Island were planted in various parts of Ohio during April. A few hundred were also planted in Indiana and Iowa, through cooperation with the Extension Foresters of those states, and five hundred more were planted on the Illinois Experimental Forest. Seedling locusts, secured from the Soil Erosion Nursery at Zanesville, were used for check planting in each instance. The purpose of these plantings is to determine the relative growth rate, quality of wood, and resistance to borer injury of this "shipmast" variety of locust.

Selection of Proper Films for Woods Photographs

Considerable difficulty has been experienced in securing detail in the half-tones of pictures taken in woods. This is especially true where it is necessary to include some sky. The usual result is to over-expose for those parts of the picture which are adjacent to the highlights and to incur a loss of detail in the smaller twigs. Auten has done some experimenting with commercial ortho, Super Speed portrait, and Panchromatic portrait films with and without K₂ ray filter. He strongly recommends the use of Super Speed portrait cut films for pictures in the woods.

Where color values are desired, the portrait Panchromatic film is superior and usually gives good results without a ray filter. It is only the very unusual picture, such as a soil profile, where there are gradations of browns and yellows, that warrant a ray filter, and here a properly-exposed portrait Panchromatic film is, as a rule, not improved much by the use of a ray filter.

The Super Speed portrait film will often enable one to minimize the effect of movement of foliage by allowing a shorter exposure.

INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Forest Management

Cut-over Land

The most significant recent developments in silvical investigations concern conditions on cut-over ponderosa pine land in Region 4. During the past 2 years most of the major cutting areas in central Idaho have been sampled by intensive surveys to ascertain the extent of the reserve stand, growth rates and reproduction. The data are being analyzed on a comparative basis.

The stocking of each of the cut-over areas was sampled by the stocked-quadrat method. Each quadrat was 25 by 22 links in size (242 sq. ft.). On some tracts a tally was made of a continuous strip of quadrats along the cruise line; on others, only the stocking of the quadrat at the end of each chain of line was noted. Record was made of stocking by stumps or dead trees as well as by living trees in order to reconstruct the condition before logging. Some of the final results for the pure pine type are presented in the following table:

Name of Area	: : Loss from : Gain from :				
	Year	: Stocked:	Logging & :	Subsequent:	Present
	of	: Before :	Subsequent:	Reproduc-	: Stocking
	Logging:	Logging:	Mortality :	tion	:
		%	%	%	%
Pine Creek - State Land	1933	85.4	8.4	0.3	77.3
Pine Creek - Boise NF	1933	80.3	4.9	0.3	75.7
Lowman - Boise N. F.	1907	79.9	3.6	3.6*	79.9
Pearsol - Payette N.F.	1924	77.3	3.4	0.5	74.4
Clear Cr. - Boise N.F.	1924	64.5	6.7	0.8	58.6
Clear Cr. - Private	1924	63.2	19.6	2.7	46.3
Rock Flat - Idaho N.F.	1922	57.6	6.5	1.8	52.9

(* Partially estimated; subsequent reproduction could not be clearly distinguished.)

The degree of cutting varied on these areas from about 50 percent of original merchantable volume cut on the Lowman area to nearly clean cutting on the Clear Creek private area. The relatively small reduction in terms of stocking caused by logging and subsequent deaths is rather surprising - from 3 to 7 percent on the various national forest areas; and only 20 percent on the private Clear Creek area, on which the slash was nearly broadcast burned. The gain in stocking from subsequent seedlings is discouragingly small. Only on the Lowman

area, cut relatively lightly 28 years ago, has the new reproduction made up for the loss from cutting. Differences of less than about 5 percent between areas are not significant, but may be due to sampling chance or to difference in aspect.

Nutrition

A study of mineral nutrients present in ponderosa pine foliage has been carried on in the laboratory in connection with a study of moisture trends in the same foliage which was conducted last summer. It has been found that there is considerable difference between the mineral nutrients in pine needles depending upon site and upon the position of the needle. The calcium and magnesium content of the needles varies more with the position of the needle on the tree than the site on which the tree is growing, there being considerably larger quantities of both elements in the needles on the lower limbs. Potassium content of the needles varies more with site than with position of the needle on the tree. Phosphorus content of the needles on the other hand, does not vary greatly regardless of the position of the needles on the tree or the site on which the tree is growing. Soil analysis are now being made to determine the apparent availability of these elements to the tree.

Snow Melt

A study to determine the influence of methods-of-cutting ponderosa pine on accumulation of winter snow on various exposures and slopes has been carried on throughout the winter. Preliminary results indicated that slow melting of snow during the winter season is desirable because ground is able to absorb all of the free water and no unregulated run-off occurs.

Range Investigations

Summer Range

Climate and Forage Yield

Variations in forage yield from year to year as a result of climatic fluctuations have long been recognized. However, the extreme nature and the importance of these variations to practical range management have seldom been fully appreciated.

Volume-yield records for an 11-year period, 1924 to 1934, on summer range at the Great Basin Branch Station, elevation 8500 feet, show variations from 54 percent to 170 percent of normal in two successive years. During the entire 11-year period, forage yield at

this location varied from 48 percent to 170 percent of normal. A 10-year record, 1925 to 1934, at Alpine Station, 10,100 feet in elevation, indicates variations of from 23 percent to 220 percent of normal. At Wiregrass, elevation 7500 feet, which approaches spring-fall range in nature, forage yields during the 10-year period, 1925 to 1934, vary from 140 percent to 61 percent of normal.

Volume yield records are not available at the U.S. Sheep Experiment Station, Dubois, Idaho, except as portrayed by records of sheep days feed secured from the various pastures. Density estimates in Paddock 1 for the three years 1932, 1933 and 1934 show that only 35 percent as much forage was produced in 1934 as in 1932. This paddock produced only 40 percent as many sheep feed days in 1934 as in 1933 and only 25 percent as many as in 1932. Density estimates on the Fremont County Burning Area, forty miles east of the Sheep Station and in the same general range type were only 35 percent as great in 1934 as in 1932.

These variations in widely separated locations and on different types of range clearly indicate the necessity of more flexible stocking limits on grazing allotments. It is not difficult to visualize the results to a range fully stocked on the basis of average forage production for ten or more previous years during a year when forage production is 40 percent of this average figure. Damage resulting during such a year may be so severe that when normal climatic conditions return, the forage production has established a new normal lower than before. Each successive dry year with stocking continued on the basis of the "normal year" may depress the forage production still further. Thus, the severe overgrazing such a range receives during a drought may serve completely to destroy several years' efforts previously put forth to build up the range to a high carrying capacity.

Spring-Fall Range

Effects of Burning Sagebrush-Grass Range on Soil

At the initiation of the Fremont County Burning Project in 1932 soil samples were drawn at 48 permanent and randomly located stations. Two samples, composites of 3 individual collections, were drawn at each station. One sample consisted of the top half inch of litter and soil, the second being a 2-inch layer of soil immediately below the litter drawn for the first composite. Standard laboratory analyses were made of these samples to determine (1) the amount of organic matter present, (2) the amount of gravel, sand, silt, and clay, (3) total nitrogen present, (4) water-holding capacity, and (5) pH. The concentration of hydrogen ion was determined by the Hellige disc comparator method.

The area was burned during the fall of 1932 and the summer of 1933. Samples were again drawn at the same stations in 1934 and were analyzed in the same fashion as in 1932. The 1934 samples, however, were classified according to the intensity of burn in which they occurred. Of the 48 stations, 17 were unburned, 8 were light-burned, 7 were medium-burned and 16 were heavy-burned.

Soil analyses of samples drawn in 1934 when compared to 1932 data show that soil changes effected by burning are relatively insignificant on burns of light and medium intensities. On burns of heavy intensity, however, a very significant decrease in organic matter in the top soil is apparent, as well as a decrease of nitrogen and moisture equivalent. Significant changes in the soil immediately below the litter were limited to decreases in organic matter and in moisture equivalent with an increase in pH values approaching statistical significance.

The 1934 soil analyses, when treated statistically to determine the effect of different burning intensities, show that the only significant soil changes are decreases in organic matter, nitrogen and water capacity and increases in pH values in the top soil on burns of heavy intensity.

Desert Shrub Range

Excellent range forage on fenced Nevada railroad right-of-way

That vegetative changes of major importance have taken place in northeastern Nevada foothills and desert ranges during the last 30 years is shown by a survey of plant cover conditions inside and outside the fenced and protected Southern Pacific railroad right-of-way. Data on the kind and quantity of plant cover gathered from 1,540 plots, about half inside and half outside the right-of-way, and extending approximately 185 miles west from the Utah-Nevada line, fell into four groups from east to west: (1) Desert-shrub foothills, 240 plots; (2) sagebrush-wheatgrass hills, 470 plots; (3) sagebrush-*Elymus* valley edges, 510 plots; and (4) desert shrub valley lands, 320 plots. In every case a line of 10 to 100 plots inside the right-of-way was compared with a similar series outside and just far enough away to avoid the zone of animal congregation at the fence. Sites selected for comparison were as comparable as possible. Serious divergences from comparability were avoided, and minor divergences compensate each other. Comparative data for major species, all of which except shadscale (*Atriplex confertifolia*) and rabbitbrush (*Chrysothamnus* spp.) are highly palatable forages, show important changes on the overgrazed range outside the protected right-of-way. These major species represent the principal forage production on the respective sites.

In the 30 miles of desert-shrub foothills, ricegrass, (Oryzopsis hymenoides) bottlebrush squirreltail (Sitanion hystrix), and whitesage, (Eurotia lanata) show decreases on the outside overgrazed range of 64, 71 and 71 percent respectively.

In the 40 miles of sagebrush-wheatgrass hills, wheatgrass (Agropyron smithii), giant wild rye, (Elymus condensatus), and bottlebrush squirreltail have decreased 43, 97 and 80 percent respectively on the outside heavily-grazed range.

On the 70 to 80 miles of sagebrush-Elymus valley edges in the Humboldt River Valley, where giant wild rye is almost the exclusive native forage there is almost no other visible vegetation inside of the right-of-way for many miles except giant wild rye sparsely interspersed with rabbitbrush. Outside the right-of-way, however, there is 78 percent less giant wild rye and 111 percent more rabbitbrush. In this mixed population, composed predominantly of a palatable and an unpalatable species, the palatable grass has been seriously depleted by heavy cattle grazing while the unpalatable rabbitbrush has increased enough to maintain the total volume of plant cover, whereas inside the protected right-of-way giant wild rye shows every evidence of having dominance over the rabbitbrush. Most of the rabbitbrush bushes inside the right-of-way are so greatly weakened by suppression that 50 to 75 percent of their branches are dead and although the number of plants is nearly as great as on the outside range, the volume of growth is somewhat less than half as great. When the grass is removed by grazing, however, the rabbitbrush becomes vigorous, quickly recovering from suppression.

The 40 miles of desert valley zone exemplifies another typical desert condition. Black sage (Artemisia nova), a highly palatable and therefore heavily grazed shrub, shows a 28 percent decrease outside the protected right-of-way. Shadscale, however, protected against unduly heavy grazing by strong, sharp spines, which frequently preserve enough foliage to keep the plants vigorous, has actually gained 37 percent on the overgrazed outside range probably by occupying space left by the decrease in black sage and other highly palatable species.

Erosion - Streamflow Great Basin

Trench terrace erosion control costs

In connection with other studies made on the Davis County area during the summer of 1934, cost studies were made on the construction of trench terraces as a system of erosion control. A brief summary of these data based on the operating costs of a 200-

man camp assuming 254 working days per year and 81 percent of the men available for field work is presented in the table below:

Trench terrace construction costs --Davis County, Utah, 1934

Method	Costs per 1,000 lineal feet				
	Cletrac 55	Cletrac 35	McCormick T40	Horses	Piazzole
Machine operation expense	\$6.13	\$9.90	\$5.25	\$10.73	None
Man-days labor	11.25	18.07	12.30	41.42	\$77.28
Transportation & Materials	0.27	0.31	0.19	0.43	0.45
Total Cost per 1,000 feet	17.65	\$28.28	\$17.74	\$52.58	\$77.73
Cost per acre (1,501.9 feet)	\$26.51	\$42.47	\$26.64	\$78.97	\$116.74

It is obvious from these figures that the total cost of terracing is much cheaper when done by power machines than with horses or hand labor. Moreover, the more powerful machines do more economical work and build better terraces than do the smaller machines. Horse-built terraces, in addition to being more expensive, have less capacity and are not as evenly constructed. The piazzole method, consisting of short, often discontinuous terraces constructed entirely by hand on areas where it is impossible to work power equipment without destroying the remaining tree cover, lends itself very well to open aspen stands, but is by far the most expensive operation.

Of the 3,769 acres in Parrish, Barnard and Ford Creeks, what is thought to be effective erosion control was obtained by terracing 228.9 acres at an estimated cost of \$11,664.74, or \$50.96 per acre. If the cost of controlling 228.9 acres is distributed over the entire area of 3,769 acres, the per acre cost amounts only to \$3.10. The damage caused by floods from these three canyons amounted to \$296,151.00, or \$78.57 per acre.

LAKE STATES FOREST EXPERIMENT STATION

Governor's Conservation Conference

At the request of Governor LaFollette of Wisconsin, the Governors of Michigan and Minnesota sent representatives to the Lake States Conservation Conference at Madison on April 24 and 25. Federal agencies including the Station were also represented at this meeting.

The States all expressed the feeling that Public Works funds should be allotted to the States more or less directly and that existing State agencies should be employed to carry out Public Works projects. Some governmental inspection should, however, in their opinion be provided preferably through some Regional representative rather than direct from Washington. A Continuing Committee was appointed for the three States involved and in addition a council made up of representatives from the various State Conservation Departments, Forest Schools, State Planning Boards, and Federal agencies was set up to advise the Continuing Committee. It was hoped that through some organization of this sort better coordination of conservation work would be brought about in the Lake States and that the three States would be in a better position to deal jointly with the Federal Government in Washington, through the Continuing Committee.

Forest Survey

Forest Survey figures are now available for the entire forest region in Minnesota. These include areas by forest types and volume of timber -- sawtimber and cordwood.

Artificial Shading Increases Survival of Planting Stock

Results of an experiment in artificial shading of newly planted seedlings in North Dakota are now available. Shading has been tried out on only a small area so far, but the results show a distinct advantage for the shaded plants. The shade provided was short limbs of brush piled on the south and west side of each tree as soon as it was planted. Shaded 1-1-1 Ponderosa pine stock at the end of the first season gave 68 per cent survival, whereas with unshaded trees the survival was only 40 per cent. The survival of shaded 2-1 Scotch pine was 45 per cent and unshaded 28 per cent.

NORTHEASTERN FOREST EXPERIMENT STATION

B-Phenology: 1934 Seed Crops

Although very low temperatures prevailed in most of the region and numerous frosts occurred in May, an excellent seed crop was reported for several species in some localities in 1934. Doctor Dorothy Caldwell at Mount McGregor, Saratoga County, New York, where considerable winter damage occurred, reports excellent seed crops for all species except service berry (Amelanchier canadensis). Never in her nine years of residence there has she seen the hemlock (Tsuga canadensis) and white pine (Pinus strobus) so heavily laden with cones. Apparently due to the abundant natural food supply, the birds were more numerous during the winter of 1934-35 than in any of the nine previous years. Occasionally twenty or more goldfinches winter there (none during 1933-34), but a flock of fifty to one hundred were seen or heard almost daily throughout the past winter.

On the other hand, in southwestern New York (Red House) where considerable winter damage occurred (1933-34), aspen (Populus tremuloides), largetooth aspen (P. grandidentata), and yellow birch (Betula lutea) were the only species which had good seed crops, those for other species being failures.

A few of the species and the general localities for which good seed crops were reported are as follows:

Abies balsamea (balsam fir): Central and southern Adirondacks, central Berkshires, throughout the White Mountains, and eastern Maine.

Acer saccharum (sugar maple): Southern Connecticut, central New York, western Massachusetts, Green Mountains, and western New Hampshire.

Betula lutea (yellow birch): The greater part of New York except the southeastern section, northwestern Connecticut, Berkshires, Green Mountains and southern Maine.

Fagus grandifolia (beech): Central and northern New York, Green Mountains, Western Connecticut, western Massachusetts, White Mountains, and southeastern and southwestern Maine.

Hicoria ovata (shagbark hickory): Western and central New York, northern Connecticut, central Massachusetts, and southeastern New Hampshire.

Liriodendron tulipifera (yellow poplar): Southeastern New York and most of Connecticut.

Picea rubra (red spruce): Adirondacks, Green Mountains, White Mountains and northwestern Maine.

Pinus strobus (white pine): Central New York, northwestern Connecticut, Rhode Island, central and eastern Massachusetts, central Vermont, eastern shore of Lake Champlain, and the Booth Bay locality in southern Maine.

Quercus borealis (red oak): Southern New York, Connecticut, southwestern, central, and northeastern Massachusetts, Merrimac River Valley (N.H.), and coast region of Maine north to Penobscot Bay.

Entomology:

MacAloney spent the last week in April on Long Island, assisting Doctor Hall of the Central States Forest Experiment Station, in his locust borer investigation. Particular attention was paid to yield plots in stands of the shipmast locust which is receiving considerable attention at the present time, because of its superior form.

MacAloney and S. F. Potts of the Forest Insects Laboratory at Melrose Highlands, Mass., carried out an experimental spraying project on the balsam woolly aphid at Grantham, New Hampshire, on April 16-18. Four one-half acre plots were sprayed with lime sulphur and miscible oils of different strengths. In the center of these plots smaller plots will be laid out and detailed observations made on the effect of the insecticide on all balsam trees present. This is an experiment to observe the recovery of infested trees, but observations on the value of the spray materials, from a control standpoint, will also be made.

NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Silviculture

Interesting information on periodicity of seed production of western white pine trees of various diameters was brought out by recent compilation of data from cone crop studies conducted during the past five years. Data were collected by annual examination of tagged trees on 15 permanent sample plots located in several cutover and a few burned-over areas on the Kaniksu and Coeur d'Alene Forests. Observations on a total of 493 identical white pine seed trees examined over the same five-year period were available for analysis. During this five-year period there were for these Forests in general one good, two fair, and two poor white pine seed years.

Data were classified by diameter and vigor class. Three vigor classes, good, fair, and poor, based on relative crown size, density, form, and to some extent color of foliage were recognized. The following tabulation gives the average percentage of the time, based on a five-year period, that trees of different vigor and diameter classes bore crops.

Average frequency of seed bearing by diameter
and vigor class of western white pine trees

Diameter	Tree vigor class		
	Good	Fair	Poor
Inches	Percent	Percent	Percent
6	0	2	0
8	0	3	0
10	12	8	5
12	24	13	7
14	49	15	13
16	43	25	30
18	45	26	36
20	45	32	60
22	44	40	20

Trees of good vigor become effective seed bearers at about 14 inches in diameter, bearing on the average at least fair cone crops 40 percent of the time, or two years out of five. Although frequency of seed bearing of good vigor trees does not seem to improve with diameters greater than 14 inches, it is known that individual western white pine trees increase appreciably in cone producing capacity with diameter. Fair vigor trees do not equal the seed-bearing ability

of good vigor trees until diameters of 20 to 22 inches are reached. Data for poor vigor trees are not reliable for trees over 16 inches due to insufficient tree basis (there were only 10 poor trees over 16 inches on all plots). However, the general trend indicates that poor vigor trees improve in seed-bearing ability with increasing diameter at a still slower rate than fair trees.

In marking practice, it is therefore particularly important that seed trees less than about 20 inches in diameter should be of good vigor.

Fire Research

A conference on fire danger measurement was held at Priest River. Represented were the ten Region One fire forests, the Weather Bureau, National Park Service, Region Four, the Intermountain and Pacific Northwest Stations, the Region One regional office, and eleven rangers from the Kaniksu.

This meeting was called for three purposes: (1) to train at least one man from each Region One fire forest in the technique of fire danger measurement. (2) To have these men tell each other how they have used fire danger measurements to get better fire control, or how they should have used them for this purpose. (3) To obtain opinions on the present methods of measuring fire danger, suggestions for improving these measurements, and ideas of profitable future fire research.

Success in the first and second objectives remains to be determined by the character and use of the measurements during the coming fire season. Success in the third objective was attested by lively discussions throughout the meeting and by ten memoranda submitted by the men representing the ten Region One fire forests.

Beginning in 1935 the restriction of smoking inside the Forests, the closure due to extreme danger, and the expansions of the protective organization above the average will be entirely or largely determined on the basis of fire danger measurements and the class of danger as shown by the fire danger meter.

To give the Region One men an unrestricted view of fire research methods, results, and possibilities, Shank of Region Four, Mowatt of the Intermountain, and Matthews from the Pacific Northwest were asked to describe their methods and results. The men were keenly interested in Shank's "Cumulative Humidity Deficiency" data, in Mowatt's "Comparison of Wood Cylinder Moisture with Humidity Deficiency", and in Matthews' "Use of Fire Hazard Sticks and the Byram Visibility Meter".

Forest Survey

Between 25 and 30 men under DeJarnette and Rowland have been engaged on compilation and preparation work. Maps for all of the area covered last summer have been coordinated, inked, and transferred to the permanent two-inch township plats.

Compilation of type areas has been done on 50% of the area covered. These have been summarized by townships. Final type area summarization by ownership classes has been made for Benewah County and is nearly finished for Spokane County.

The Office of Engineering in the Regional Office has started the work of compiling 1"-to-the-mile maps to receive the type information which will be put out on the 1"-to-the-mile scale. The maps are being compiled in units of 40 townships.

The available estimates have been completed for all of the area west of the Continental Divide with the exception of a small amount of county and National Forest information in the extreme eastern part of the area.

Cummings has been making plans for the growth studies which will be necessary for this phase of the Survey. His plans include studies in white pine, larch-Douglas fir, ponderosa pine, and cedar.

Whitney and Hutchison have recently completed a survey of the fuel wood situation for the city of Missoula. Missoula is the first of a number of Montana and Idaho towns to be studied in order to determine the urban fuel wood requirements and depletion in Region One. A similar survey is being made for the rural areas.

It is notable that of the 10,535 cords of wood burned in 1934 only 763 cords were cut from green trees. Twenty-five hundred seven cords were slab wood and the balance bug and fire-killed wood.

Several woodmen state that they are unable to get enough wood to fill their orders. One dealer reported that he turned down 100 orders in a month. To relieve this situation the State Forester is contemplating the building by CCC labor of a road up into the Twin Creeks drainage in order to make a stand of dead lodgepole pine available.

Forest Products

Tentative arrangements have been made for a cooperative woods and mill study in the western white pine type in northern Idaho in a 120-year old stand now being operated by the White Pine Lumber Company of Orofino, Idaho. It will be possible to follow the various

activities from the stump through the sawmill and thence through the company's match block factory in Orofino. Sample blocks indicative of certain tree and stand characteristics may also be manufactured into match sticks and standard strength tests made on these sticks. Dr. E. E. Hubert of the Western Pine Association has tentatively agreed to carry on this part of the study.

The report on the larch-Douglas fir woods and mill study should be ready for distribution by July 1. In the tie operation studied it was found that the zero margin for larch and Douglas fir occurred at 12 inches d.b.h. Production costs did not include stumpage. When this item is included, the zero margin tree increases to 14 inches d.b.h.

During the month Bradner, Anderson and P. Neff (Code Administrator) of Region One completed the annual lumber manufacturing cost trip at which time detailed logging and manufacturing costs were obtained from 24 band mills operating in the Inland Empire region. Lumber manufacturing costs were in general about 18 percent higher in 1934 than in 1933. The weighted average annual manufacturing cost for all mills increased from \$10.36 per M feet b.m. in 1933 to \$12.22 in 1934. The increase in cost varied from an average of 20 percent in the Idaho white pine mills to 10 percent in the mills cutting principally ties, mining timbers, and match plank. Most of the increase in cost is attributed by the lumbermen to the higher wages and shorter hours required under the Code. This seems to be a reasonable assumption as an analysis of the direct manufacturing charges shows an increase of 31 percent in 1934 over 1933. Direct costs include besides wages, equipment, supplies, fuel and repairs, all of which were somewhat higher during the past year. The effect of Code regulation on the cost of manufacture is strikingly shown in the increase in the selling cost. The cost of selling lumber due to the charge of eight percent for commissions increased between 40 and 50 percent.

The 1934 cut of lumber was approximately 24 percent greater than that of 1933. Twenty identical mills cut 484,330 M feet in 1934 as compared with 391,520 M feet in 1933.

Range Research

The sixty experimental cows at Miles City that have been on a hay ration on feed lots since last November were moved to their regular winter range early in April. Old forage was so scanty and new feed so short that supplemental feeding of hay to all lots was necessary for a time but this feeding has now been discontinued for all lots except those on overgrazed pastures. At the end of April moisture in the soil was evident at an average of 12 to 15 inches and prospects for spring growth are much better than in 1934. The

calf crop now stands at about 50% with the prospect that it may reach 75% on some lots.

Five new range reseeding cooperators have been added to the previous list of thirty. Nearly all of the latter will have spring drilled areas for comparison with those seeded last fall. The total spring seeded area will reach about 400 acres, the bulk of which will be crested wheat grass, but a dozen other species are included in the program. Based on a recent examination of areas drilled late last fall the prospects are favorable for successful stands. Some of the early fall drilling that came up with September moisture succumbed during the dry October and November weather.

Twenty range quadrats on the Absaroka and Deerlodge National Forests originally charted in 1916 and ten of which were denuded, were recharted last summer. Of eight quadrats denuded 18 years ago, six of them still have a much poorer cover of vegetation than the not denuded companions on the surrounding areas in the case of protected as well as grazed samples, some of which are on timbered range. Two denuded quadrats on grazed grass-weed range now have a slightly greater vegetative cover but the percentage of weeds is greater than the two undenuded grazed companions.

PACIFIC NORTHWEST FOREST EXPERIMENT STATION

Experimental Forests

About mid-month the annual transplanting at the Wind River Arboretum was carried out. In addition to the new plantings, this year's arboretum work included the preparation of a map giving the location of each specimen tree on the tract and the completion of the graveled trails which were laid out last season.

ECW Foreman Frost opened up the station at Pringle Falls after breaking his way through deep snow for six miles. The purpose of the early opening was to take advantage of snow and moisture conditions and burn down pine snags on a 320-acre demonstration plot. Information on the "base fire" method of burning down snags of various ages and types is desired. The project was carried out cooperatively with the Deschutes Forest, which supplied four CCC enrollees and, for a time, a man experienced in snag burning.

The first plantation at Pringle Falls was established late in April with the planting of Scots pine (*P. sylvestris* var: *mongolica*), Austrian pine (*P. laricis* var: *nigricans*), Corean pine (*P. Koraiensis*), and Jeffrey pine.

Section of Silviculture

Fire Studies

Matthews and Isaac visited the Port Orford cedar cruising project and selectively logged areas in Coos County and made plans for their joint study of partially cut areas. Vose is trying out a tentative system for uniform appraisal of fire hazard based on the use of plots taken at arbitrary intervals in much the same way that stocking is determined by the stocked quadrat method.

Matthews attended Gisborne's fire danger training school at Priest River, and found that Regions 1 and 4 plan to make considerable administrative use of the fire danger measurements. Matthews talked before about 20 staff men at the Portland Regional Office including assistant regional foresters. He exhibited a complete fire danger station as used in Region 6 and explained the philosophy back of their use.

Morris has been devising a method of measuring crown opening, designing a simplified relative humidity table, supervising Ward's fire weather studies, and with the help of Crombie has been preparing and sending out hazard indicator sticks, record forms, and instructions for the fire danger stations. About 200 sets of sticks and other items in proportion were prepared this year.

Byram is completing 50 haze meters that were started about a year ago with emergency labor. There are already 50 on the forests and with these additional haze meters it will be possible to make an extensive field test of these instruments.

Management in Ponderosa Pine

Two phases of this major project were given considerable time. Meyer, Kolbe, and Rapraeger were in conference a number of times with Ericson of the Regional Office and Keen of the Bureau of Entomology preparing plans for a joint marking project on the Malheur. The objective is to determine whether present cutting methods may be modified in the direction of a lighter cut for a higher per unit money return, at the same time leaving a residual stand with a lessened insect mortality hazard and in a condition for rapid growth. It is the plan to mark two 160-acre areas for cutting. On one, only the insect-susceptible trees are to be removed. On the second, the cutting will take both slow-growing trees and also those otherwise undesirable for best silvicultural conditions. On this second plot the cut will be from 40 to 60 percent of the volume. The 160-acre areas are believed large enough to furnish reasonably reliable averages on mortality and growth.

Kolbe with the Bureau of Entomology, planned a study to determine some of the interrelationships of insect losses to silvicultural treatment and tree types. This will include a study of ecological factors influencing growth and mortality on cut-over areas.

Douglas Fir Silviculture

Stand improvement and the study of old and new partially cut areas will be the phases of Douglas fir silviculture that will be stressed under the expanded program, and Isaac spent considerable time working out the details of this project. Stand improvement particularly will be centered on the Wind River and Cascade Head Experimental Forests.

Section of Forest Products

Census of Lumber, Lath and Shingle Production

Johnson spent a large part of the month in the field contacting operators who had not yet submitted their census schedules. To date 1,717 completed schedules have been forwarded to Washington. This work should be brought to a close early in May.

Cooperation--R.O.

Lodowick prepared a tentative work plan for the establishment of experimental pole durability telephone lines on the national forests. The plan is to have three of the lines scheduled for rebuilding this year set up as experimental lines with a definite sequence of species, treatments, and untreated checks. Ten to twelve miles of line will be put in on the Deschutes National Forest, the Willamette National Forest, and the Siuslaw National Forest. Each will have twenty five repeats of each treatment. The lines are to be established by the Regional Office and periodic inspections are to be carried on by the Section of Products.

Arrangements have been tentatively agreed upon whereby the Section of Products will inspect recently installed lines treated with Anaconda Paste and set up certain selected lines for periodic examination.

Mill Production Studies

Preliminary work plans have been prepared for the production studies to be carried on in eastern Oregon and Washington in conjunction with logging studies by Brandstrom.

A preliminary work plan for the contemplated output studies project in small Douglas fir mills has been prepared.

A start was made on rough-drafting the office report on the two small mills studied last autumn.

The projected woods and mill study at Deer Park, Washington, which was to have been carried on by the University of Washington, has been postponed because of the lateness of the season. The Biles-Coleman operation has been selected instead, which will mean a certain degree of cooperation and help from this Station. Rapraeger spent several days at Onak in conferences regarding marking and procedure.

Deterioration of Fire-Killed Timber

The combined report of Entomology, Pathology, and Products has been rough-drafted and will soon be in shape for criticism by the cooperating agencies.

Forest Economics

Logging Economics

Brandstrom continued on detail at Washington, D. C., working with Kirkland on the revision of their manuscript "Principles and Procedures of Selective Timber Management in the Douglas Fir Region". He is expected back by May 15.

In Brandstrom's absence, Rapraeger made arrangements for the start of the ponderosa pine study.

The Western Pine Association and University of Washington will also carry on a complete logging and milling study at the operations of the Biles-Coleman Company at Omak in eastern Washington. Rapraeger visited Omak the latter part of the month to assist in outlining the work.

Land Economics

Correlation of cover with lay of the land by slope classes, and of tax delinquency with lay of the land by slope classes for the agricultural lands within a sample area in Clallam County was completed. Lands delinquent for 1930 and prior taxes were compiled by ownership classes in Clallam and Jefferson Counties, Washington, and similar compilations are under way for Coos County, Oregon.

Correlations of tax delinquency with cover, with soil classes, and with ownership classes were completed for five sample school districts in Columbia County, Oregon. In addition a new balance sheet of county owned lands by cover types was struck off for all of Columbia County, showing the amount on hand April 20, 1932, the amount sold by the county between April 20, 1932 and February 10, 1935, the amount acquired by the county through forfeiture for unpaid taxes between these dates, and the balance on hand as of February 10, 1935. This compilation shows what reversion normally may be expected when the supply of virgin timber within a forest county nears exhaustion, a matter that has been somewhat overshadowed by the extent of tax delinquency among all classes of real estate acreage in forest areas from 1926 to 1934.

Mensuration

Spruce-Hemlock Yield Study

Visions of an early completion of the spruce-hemlock yield study were shattered when certain irreconcilable differences between the data gathered in different regions became more and more magnified as the

study progressed. A complete set of tables had been prepared but they are being revised in the attempt to eliminate inconsistencies.

Ponderosa Pine Yield Study

As in the spruce-hemlock yield study, the ponderosa pine study also shows great differences in data between regions. The project is therefore temporarily laid aside until the spruce-hemlock study is near completion and use can be made of the experience gained. In the pine study, the difference is chiefly one of stocking, but in the spruce-hemlock study, the difference is one of diameter distribution. At the beginning much use was anticipated of "stand density index" in both projects, but apparently it becomes unreliable when partial stand values are handled.

Forest Survey

The usual large number of requests for the 1-inch-to-the-mile colored type maps were received during April. A number of these requests came from the county assessors, and the assessor of Multnomah County (in which Portland is located) obtained the maps for nine neighboring counties.

Most of the field map sheets for the three counties in eastern Washington, Pend Oreille, Stevens, and Spokane, mapped by the Northern Rocky Mountain Forest and Range Experiment Station, have been received and translated to our type scheme and 1-inch-to-the-mile county maps are being drafted for these counties. The report on assumed future depletion in the eleven forest units of the Douglas fir region for the next three decades has been completed by C. W. Kline. These data are correlated with decadal growth to arrive at future inventory at the decadal intervals.

Douglas Fir Region

Progress on the reports for the eleven forest units of the Douglas fir region is steadily continuing. On May 1 the job was about 60 percent completed. Three unit reports are completed; the North Puget Sound, the Columbia River Washington, and the North Oregon Coast Units. The Central Puget Sound Unit report is 75 percent complete, the South Puget Sound 85 percent, the Columbia River Oregon 70 percent, the Willamette River Unit 6 percent, the Umpqua River 45 percent, the South Oregon Coast 70 percent, and the Rogue River 15 percent complete.

Ponderosa Pine Region

The inventory phase computations have been progressing rapidly and type areas have been completely compiled for Klamath, Deschutes, Jefferson, and Wasco Counties, Oregon, and practically completed for Kittitas County, Washington. Timber volumes have been compiled for Klamath and Wasco Counties, Oregon.

In April six men were added to the field force, making a total of eleven men now in the field. Five of these were without previous experience with the Survey and are now undergoing intensive training in the technic of type mapping. Of these eleven men, eight are working in eastern Washington and three in eastern Oregon. This spring has been the latest in years and the presence of snow in most of the country, together with the poor condition of roads wherever the snow is off, has materially hampered progress in field work. Arrangements have been completed to take ten rolls of aerial pictures in the Whitman and Wallowa National Forests.

SOUTHERN FOREST EXPERIMENT STATION

Forest Survey

Two pulpwood reports, No. 11 "Pulping and Non-Pulping Cordwood Volume in Survey Unit No. 2 Mississippi", and No. 12 "Pulping and Non-Pulping Cordwood Volume in Survey Unit No. 2 Georgia", were released.

Briefly summarized, these reports present the following information:

Report No. 11: Approximately 38 percent, or 3,089,100 acres, of the 8,153,500 acres in Mississippi Survey Unit #2, is forest land. Ninety-six percent of the forest area is in second-growth stands; 55 percent is in the pure pine and mixed pine-hardwood types. The timber volume in the Unit in live, sound trees is estimated at more than 29 million cords, of which more than 15 million cords are in pulping species. Well-distributed roads and railroads make all parts of the Unit accessible. No figures for average growth are as yet available.

Report No. 12: Georgia Survey Unit #2 covers an area of nearly 5,586,000 acres, of which approximately 54 percent, or 3,020,400 acres, is forest land. Nearly 70 percent of the forest area is in second-growth stands. Eighty-eight percent of the total volume of cordwood, or nearly 17 million cords, is in pulping species; but almost half this amount (7,931,000 cords) is composed of round, and working and idle turpentine trees. The Unit is exceptionally well furnished with railroad lines and highways. No estimate can be given at present regarding the availability of the pulpwood supply because the growth rate and prior claims of other forest products industries have not as yet been established.

The Survey is making a thorough check of the cropmeter to find out if it is possible to get satisfactory results in a given Survey unit by any cheaper or easier method than the line-plot survey now used. The tests that have been made are based on the following concepts: There are available for a given Survey unit the figures derived from the line-plot survey, which may be considered the statistical universe. A network of highways with a mileage equal to or greater than the mileage of the line-plot survey is laid out in such a way that every part of the Survey unit is more or less uniformly transected by the highways chosen. Two observers then drive along the roads in the network, recording on the cropmeter the forest types, forest conditions, stages of turpentinizing, and so on, as they occur along a strip immediately adjacent to the highway. This strip is usually five chains wide and is usually taken on the right-hand side of the road. The cropmeter is nothing more or less than a long bank of speedometers which record the footage traveled while the key is punched

down for any given condition. It is possible after any day's run to find the percentage of distance traveled in each of the categories set up. Through this device, it is possible to get the area distribution of the chosen categories, such as types, conditions, etc., along the highways.

After a cropmeter survey of a given unit is completed, the results are compared with those found in the line-plot survey, in an attempt to establish a factor of discount or increase that will convert cropmeter figures into line-plot figures.

Two units, Georgia Unit #1 and Florida Unit #1, have now been surveyed by both line-plot and cropmeter. If the results show consistent relationships, there are several possibilities ahead:

1. To greatly reduce the costs and time involved in making line-plot surveys. (It is interesting to note that two men in a car can cover 100 miles of highway strips in a day. Three men, with a car in attendance, can only cover 2-1/2 miles of line-plot survey in a day.)
2. Taking an annual inventory or rather a rechecking of inventory in a given Survey unit by comparing the periodic cropmeter results with the original line-plot data, thus ascertaining changes that might have occurred in the meanwhile in area of clear-cut land, in amount of uncut timber, in amount of abandoned turpentine crops, and a number of other features, all of interest or importance.
3. The use in extensive surveys for such territories as the post-oak region of Texas.

While it appears doubtful that the cropmeter will have such possibilities as to surpass the line-plot surveys, it may have a supplementary value in all line-plot surveys in finding and checking figures on distribution, and is quite likely to have a real value for extensive surveys, such as that in the post-oak region mentioned above.

Forestation

Wakeley and Olsen, with the assistance of Chapman, completed the 10-year remeasurement of heights and diameters on 12 acres of the Coburn's Creek plantations at Bogalusa, La., approximately 10,000 trees. Supplementary measurements of crown length, crown width, and probably branch diameter are to be made of a portion of the total number of trees chosen by mechanical sampling. Inspection of the field sheets shows the following maximum sizes for

trees 10 years in the field and 11 from seed:

<u>Height, in feet</u>			<u>Diameter, in inches</u>		
<u>Longleaf</u>	<u>Slash</u>	<u>Loblolly</u>	<u>Longleaf</u>	<u>Slash</u>	<u>Loblolly</u>
25.3	37.4	28.6	5.2	7.0	7.2

In making the 10-year remeasurement of plantations, difficulty was experienced in measuring the heights, because the stands were too dense for efficient use of a hypsometer, and no measuring pole yet designed and described has proved satisfactory for heights greater than 30 feet. Poles with solid members, when extended 30 feet or more, are either too limber for use without extreme and time-consuming care or too heavy for one man to handle. Work is now under way on a pole of open work truss design capable of being extended 35 or 40 feet.

In the nursery, this year particular attention is being paid to the seedling life-history studies, which are elaborations of similar studies undertaken for the first time last year. The object is to learn the details of the development of normal seedlings under standard nursery practice, together with the course of air and soil temperature changes, and changes in evaporation rate under which they occur. The normal life-histories obtained in this way are essential not only as a basis for comparison with those seedlings under special treatment and seedlings injured in various ways, but also as a guide in planning modifications of existing nursery practice. The principle involved is the same as the one receiving increasing emphasis in medical research, namely an improved knowledge of normal development as a starting point for studying the abnormal or pathological case.

Hatfield of the Bureau of Plant Industry, assisted directly in both the nursery and seed studies of the Station by making a preliminary survey of seed-infection conditions at the nursery and in the seed-extracting plant. He collected, for culturing, numerous seeds failing to germinate, or dying during the process of germination, in connection with the studies of tree percent. Analysis of all available data indicates that the greatest loss of potential plantable stock occurs in the brief period between sowing and the removal of the burlap or pine-needle cover. Indications are that unfavorable moisture conditions and pathogenic fungi are among the most important causes of this loss. In the Station's current studies the problem is complicated by the use of seed that, because of delay in completing the extracting plant, was left too long in the cones. Molding, fermenting, and even germination between the cone scales took place in many lots of cones awaiting extraction. The extensive molding of cones, followed by spoiling of extracted seed under conditions normally safe for temporary storage, is the occasion for the second part of Hatfield's preliminary study, in which he obtained

culture material from seed not yet sent to the nursery. It is hoped in this way to learn the relative importance of seed-borne and soil-borne organisms in causing loss of seed after sowing, and to devise ways of preventing the loss. The possible need of fumigating the extracting plant is being considered.

Financial Aspects

A brief summary to date of the work on the Crossett Experimental Forest is as follows:

The work started there in the summer of 1933, has had three main phases, namely, (1) preparation of management plan for, and marking of, Unit #1 of the East Block, for the Crossett Lumber Company; (2) a truck-logging study by Reynolds under his Pack Fellowship; and (3) development of the Crossett Experimental Forest.

Reynolds' first work was a study of the possibilities of managing the 30,000 acres of virgin and second-growth loblolly-shortleaf pine-hardwood in the East Block on a sustained-yield basis, and marking the timber to be removed in the first cut. This work started in 1933 under Wackerman. Reynolds was later hired by the company on a cooperative basis to do the intensive cruising and marking of the block. A preliminary inventory was made by Wackerman in 1933. Management plans involved call for a 10-year cutting cycle on a selective-logging system, to remove 10 million board feet a year. The first unit was marked by Reynolds with the help of five CCC boys during the summer and fall of 1934. The marking included a 100 percent inventory of the trees 13 inches or more in diameter breast high on the first-year's cutting unit, or 3,000 acres. Diameter cutting limits were on a sliding scale. Pine trees in the virgin stands 24 inches and more in diameter breast high were marked for cutting, while in the second-growth stands all such trees 22 inches and more in diameter breast high, were marked for removal. In all stands, trees below these limits and more than 13 inches in diameter breast high which were unsound, crooked, badly suppressed, or otherwise defective were marked. Sound and fast-growing trees over the top-diameter limits to the extent of equivalent volume per acre were left to make up for defective trees below the above limits that were marked for cutting. In this work, in view of its being the first attempt in this region to mark such an area for sustained yield, the method used on this first unit must be regarded as a trial.

The costs of inventory and marking per thousand feet, based on the pine to be removed, averaged 15 cents; on the basis of total pine stand, 7 cents; on the basis of pine and hardwood to be removed, 10.3 cents; and on the basis of total stand, 5 cents. These costs included labor and supervision, brushes, paints, and incidentals for both the inventory and the marking.

A check of the cruise data has been made on about 700 acres of Unit #1. The cruise data showed that 3,772 thousand board feet of pine were to be removed, while the volume actually removed, as per log scale, was 3,790 thousand board feet, indicating an accuracy of 99-1/2 percent in the cruise.

The Crossett Lumber Company is now very much interested in selective logging for sustained yield. In the earlier days, it used railroad logging entirely, cutting to a much lower diameter limit, amounting in many cases to a clear-cutting with seed trees. Under the new system, railroad spurs will be laid about 1/2-mile apart, logs from the "backs" will be hauled to the spurs with horses and 8-wheeled wagons, and those close to the spurs will be skidded directly. While railroad overhead per mile will be greater per thousand feet of timber removed, the total logging cost will probably be cheaper under the new method than under the old. The new method will remove about 43 percent of the volume per unit.

Entomology

Dr. Snyder made a trip to the Ozark National Forest with R. A. St. George to inspect T. S. I. work in shortleaf pine by felling or girdling from the standpoint of barkbeetle attack. No southern pine beetles were present and Ips spp. were not a factor. Girdled trees died very slowly.

With G. M. Hunt of the Forest Products Laboratory, and E. W. Gemmer of the Southern Station, Dr. Snyder inspected sites near New Orleans, La., for the placement of the new local tests of wood preservatives. A favorable site was finally selected on the Harrison Experimental Forest.

An article, entitled "Membracid Girdling of Young Black Locust Seedlings in Southern Louisiana and Mississippi", was published in the April issue of Louisiana Conservation Review, pages 9-10, and 47, figures 1-5.

A species of fossil termite (Reticulitermes creedei, n. sp.) has been sent to Dr. Snyder for description. This is the ninth species of fossil termite found in the United States and was discovered in Niocene shale at Creede, Colo. A living species of Reticulitermes occurs in Colorado at elevations below 7,000 feet. A short paper has been prepared for publication on this fossil termite.

Plans were made for partial physical survey of termite damage to buildings in New Orleans and other cities on the possibility of PWA funds being allotted. Two FERA workers have nearly completed plotting a map of New Orleans, showing the location of approximately

3,000 buildings inspected by termite-control operators, whether termites were present, and how treated. The data were obtained from file records, since FERA labor hours were not adapted for actual surveys. This map will be useful in determining where to make the partial survey of New Orleans with PWA funds.

Dr. Snyder reported to the Staff concerning his trip with Dr. Craighoad to the Canal Zone. They went to Barro Colorado Island in Gatun Lake, near the center of the Isthmus, to inspect the termite-control tests originally established there in 1924. Additional termite tests were established in 1929, in connection with an international test of which Barro Colorado is one station. Duplicate samples of wood or composition products to be tested were sent to South Africa, Australia, Hawaii, and Panama. These samples are being tested as to their resistance to termite attack and also to fungi, weathering, and moisture. The wood tests at Barro Colorado are being made by the Bureau of Entomology and Plant Quarantine in cooperation with the Forest Products Laboratory, Madison, Wisc. Species tested on the Island include redwood, cypress, heart longleaf pine, and native Panamanian and Brazilian woods, as well as composition materials such as Masonite and celotex. The tests included not only untreated woods but those treated with various chemicals, preservatives, and repellents, such as creosote, zinc meta-arsenite, chlorides, and so forth. Not only are small panels and posts used in these tests, but poles and variously constructed buildings. The larger buildings are 19 by 19 by 14 feet.

Barro Colorado Island was originally the top of a small mountain, but with the flooding of Gatun Lake incident to the construction of the Panama Canal, it became an island about 3-1/2 miles in longest diameter, containing about 6 square miles. It is separated from the mainland, and the Panama Railroad, by the 3 miles of Frijoles Bay of Gatun Lake. This isolation resulted in frequent unpleasant occurrences for Dr. Snyder's party, owing to the temperamental nature of the only means of transportation, an outboard motorboat. Docking facilities were also not of the best on the Island, resulting on one occasion in an involuntary bath in the Lake for the party, when a floating dock capsized.

Barro Colorado is a Government game preserve and has a large variety of wild life. It is also a reservation for the Institute for Research in Tropical America, and a base for studies by the Bureau of Plant Industry, Bureau of Entomology and Plant Quarantine, and Forest Service of the Federal Government.

In 1924, there were no trails on the Island, so the party had to hack its way through the jungle with machetes. Today there are 20 trails, covering the whole island. Several residences and a laboratory have been built, and on the highest point of the Island, 650 feet above the Lake, a fire-and-observation tower has been placed. A

detailed map of Barro Colorado has been made from the air by the Army.

The mean annual rainfall is 101.73 inches, whereas that at Balboa, on the Pacific coast, is only 66.7 inches, and that at Cristobal, on the Atlantic Coast, is 136 inches. January to April comprises the dry season, while the heaviest rains come in November. (The mean annual rainfall in New Orleans is 56 inches.) This climate results in a very dense, tropical vegetation consisting of trees, shrubs, and herbaceous plants, all covered to a greater or less degree with lianas, lichens, fungi, and other evidences of dank, dark jungles. The plant life of the Island includes a very wide variety of species.

Biology

Mr. T. D. Burleigh, Associate Biologist with the Bureau of Biological Survey, established his headquarters with the Experiment Station on April 14, 1935.

RESEARCH IN REGION 2

Degrees of cutting in commercial stands of southwestern ponderosa pine (Mc - 101, San Juan):

The following information for the first decade after cutting has been obtained on three 2-acre plots located near Pagosa Springs on the San Juan Forest.

Plot Number	Orig. Volume	Residual Volume	Percent of Orig. Volume	Acre - annum increment		
	Bd. Ft.	Bd. Ft.	left	Cubic foot Gross	Net	Board foot Net
1	10691	4691	43.9	36.8	36.8	183.8
2	10498	4256	40.5	32.8	32.6	153.6
3	13383	9418	70.4	33.0	33.0	180.8

Plots 1 and 2 were cut practically to the same degree and may be thrown together in comparing the relative performance of residual stands containing 40 percent and 70 percent of the commercial volume of the original stand. From the standpoint of cubic volume, the more heavily cut stand shows a higher rate of increment than the more lightly cut stand, but the difference is small. On the other hand, the net acre-annum increment in board feet of the more lightly cut stand has exceeded by about 7 per cent (based on its own volume) the corresponding average increment of the other plots. On the basis of percentage of increment, it is obvious, however, that Plots 1 and 2, averaging about 4500 board feet in residual volume, have made far better growth than has Plot 3, with a residual volume of approximately 9400 board feet, the respective values amounting to 3.8 per cent and 1.9 per cent. The amount of loss on the experimental area for the 10-year period was negligible in quantity. The results to date concerning the relative merits of light as against moderately heavy cutting that removes somewhat more than one-half the original volume on the best sites for the species indicate that the latter method constitutes the better economic practice.

Thinning in lodgepole pine (Mt-103):

The final results, covering a 23-year period, for the three Long Creek plots on the Washakie Forest, established in 1911, are essentially in agreement with the results and conclusions based on 18 years of study which were presented in 1933 in a technical contribution by the Station. The average diameter increase of the residual trees in a stand thinned from below to 1294 trees per acre amounted to 1.44 inches in 23 years. In the case of the stand thinned

from above at the same time to 1172 trees per acre, the corresponding increase amounted to 1.39 inches. Within the unthinned control stand, the increase was 0.91 inch. The respective average diameters in 1911 of the trees comprising the residual stands were 3.27 inches, 3.45 inches, and 2.78 inches.

In 1909, three plots were laid out near Foxpark, Wyoming (Medicine Bow Forest) in the lodgepole pine type in a 33-year old stand that had come in following fire. Two of the plots were thinned to densities of 4800 and 2700 trees per acre. These densities reflect a very conservative tendency in thinning with which present administrative practice is not in accord. The third plot was left unthinned as a control. Its density averaged 9100 trees per acre.

The average diameter growth of living residual trees has varied directly with the degree of spacing in the residual stands. The rate of decline in growth, however, has been approximately the same on all of the plots when the growth rate of the first 5-year period is compared with that of the last 5-year period. This indicates that while thinning resulted in a stimulation of growth, as expected, its effect was temporary only, owing to its conservative nature.

The results covering 25 years of study are briefly summarized as follows:

	Plot 10 (unthinned)	Plot 9	Plot 11
Number of trees per acre	9100	4800	2700
Average diameter residual stand (inches)	1.463	1.330	1.775
Total increase in diameter, 25 yrs. (inches)	.735	.962	1.222
Average height residual stand (ft.)	12.23	9.97	13.77
Total increase in height, 25 yrs. (feet)	6.38	6.47	7.26

The most interesting part of the record probably pertains to that which shows that the more heavy thinning resulted in the fastest growth in height. However, no difference in this respect is to be noted as between the more lightly thinned and the unthinned plot and it is possible that site may be partly responsible for this particular condition. At any rate, the results in general have proven of more academic than practical value, and the project is to be closed.

Data were also compiled and summarized showing the effect of cutting on subsequent growth in overmature stands of lodgepole pine on the Medicine Bow Forest. The stand involved is on Hay

Creek and is typical of the merchantable lodgepole pine type running better than 20,000 feet per acre (prior to cutting) and 200 years in age. Three 1/2-acre plots are included. One of these was cut to a 7-inch diameter limit, another to a 11-inch limit, and the third was left in its original state. The heavy cutting on the first of these plots was accompanied by considerable destruction to unmerchantable trees, and was followed by rather heavy losses due to windthrow, the site being an exposed one. To all intents and purposes, the two methods of treatment approximated clear-cutting in the case of the 7-inch limit, leaving 2516 board feet, and a group selection cutting in the case of the 11-inch limit, with 9594 board feet left. 23912 board feet of timber comprised the uncut stand on the check plot. The net per acre-annum increment for the period 1922-1934 was 58.8 board feet for the heavily cut, 103.0 board feet for the less heavily cut and -88.8 board feet for the check plot. On the latter plot mortality was high, practically all of the loss being in standing trees. Gross increment per acre-annum rates, for the plots in order, were 90.0, 137.0, and 122.5 board feet. In comparison, this represents a very favorable showing for the cut-over plots, particularly that plot which was cut to a 7-inch limit. On this plot a good stand of reproduction has already established itself.

Weather:

At the Fremont Station, the weather continued excessively dry until Apr. 17. Frequent storms since that date have improved a situation that was critical in the extreme, and have provided sufficient moisture to make it possible to undertake spring planting on the Forests east of the Continental Divide and to allay fears of a water famine. Although the station lies some 200 miles northwest of the center of disturbance in southeastern Colorado and at an altitude of 9000 feet, frequent dust storms were reported in March and April. The snow delivered by the first heavy snow-storm of the winter on April 17 was literally grey in color from dust. The water equivalent of the snow caught in the tipping bucket rain gauge was 0.84 inch. Upon evaporation of this water, 2.76 grams of very fine soil were precipitated, or the equivalent of 337 pounds per acre.

MANUSCRIPTS

PACIFIC NORTHWEST

Lodewick, J. E.	Pulpwood conversion factors in the Pacific Northwest. (Office report)
Lodewick, J. E.	Pulpwood conversion factors in the Pacific Northwest (Submitted to Pacific Pulp & Paper Industry)
Lodewick, J. E.	Noble fir for "larch". (For The Timberman)
Moravets, F. L. and Cowlin, R. W.	Report on North Puget Sound Unit (Washington)
Bolles, W. H.	Report on Columbia River Washington Unit
Kemp, P. D. and Cowlin, R. W.	Report on North Oregon Coast Unit

INTERMOUNTAIN

Connaughton, C. A.	Forest fires and accelerated erosion. Submitted to Journal of Forestry
<hr/>	The influence of vegetation on the accumulation and rate of melting of snow. Submitted to Journal of Forestry.
Mowat, E. L.	Growth in selectively cut ponderosa pine stands (Salmon National Forest) Mimeographed.
Read, W. B.	Ponderosa pine planting. (For distribution in Region 4.)

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| Bolles, W. H. | The Swedish gang saw. (N.Y. State Ranger School Alumni News, 1934) |
| Brandstrom, A. J. F. and Rapraeger, E. F. | Tractor trails--where do they lead? (O.S.C. Annual Cruise 1935) |
| Bull, Henry. | Thinning loblolly pine in even-aged stands. (Jour. of For. May 1935. |
| Cowlin, R. W. | No trees for old. (O.S.C. Annual Cruise, 1935) |
| Lister, P. B., Walter P. Taylor and Charles T. Vorhies | The relation of jack rabbits to grazing in Southern Arizona. (Jour. For. May, 1935) |
| McArdle, R. E. | A visibility meter for forest fire lookouts. (Journal of Forestry, April 1935) |
| MacAloney, H. J. | The balsam woolly aphid in the Northeast. (Jour. For. May, 1935) |
| Matthews, D. N. | Experience with hazard indicator sticks. (Jour. of Forestry, April 1935) |
| Wahlenberg, W. G. | Effect of fire and grazing on soil properties and the natural reproduction of longleaf pine. (Jour. For. March, 1935) |

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- No. 66. Ungunstiger Einfluss Einer Zu Grossen Stammzahl Auf Den Wasserhaushalt Geringer Kiefernboden (Unfavorable Influence of Too Dense a Stand on the Water Regime of Poor Pine Soils) By Prof. Dr. Albert, From Zeitschrift Fur Forst- Und Jagdwesen, Vol. 47, 1915. Translated from the German by Dr. De Blumenthal, March 13, 1935.
- No. 68. Impressions Forestieres De Yougoslavie (Forest Impressions from Yugoslavia) By H. Perrin, From Revue Des Eaux Et Forets, Vol. LXX, VII Series, Translated from the French by A. H. Krappe, October 31, 1934.
- No. 69. L'Ire Et Son Basin (The Ire and Its Basin) By Pierre Buffault. From Revue Des Eaux Et Forets, Vol. VII, VII Series. Translated from the French by A. H. Krappe, September, 1934.

